Data for EBSP

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There are some data for the paper of "Routing and Scheduling of Electric Buses for Resilient Restoration of Distribution System"

1. Parameters in the case of IEEE 33-node system

1.1. Transfer time and duration of trips

Table 1: Transfer time and duration of each trip

ΔT	o1	c1	c2	c3	b1	b2	e1	e2
o1	0	1	1	1	2	1	M	M
c1	1	0	1	2	2	1	M	M
c2	1	1	0	1	1	2	M	M
c3	1	2	1	0	2	1	M	M
b1	M	M	M	M	0	M	6	M
b2	M	M	M	M	M	0	M	8
e1	1	2	1	2	1	1	0	M
e2	1	1	2	1	1	1	M	0

where o1 represents the depot 1; c1/c2/c3 represents the charging station at node 9/18/29; b1/b2 represents the start point of route 1/2; e1/e2 represents the end point of route 1/2. The elements in rows represents the beginning of a trip; The elements in columns represents the destination of a trip.

1.2. Interruption cost of each load

The interruption cost of each node is listed in Table 2.

Table 2: The interruption cost of each node

Node	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Value($/kWh)	9	2	2	8	7	5	3	2	2	4	10	3	5	6	9	9	2
Node	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	/
Value($/kWh)	8	3	4	7	8	2	5	5	2	8	4	6	6	6	9	7	/

2. Parameters in the case of IEEE 123-node system

2.1. Transfer time and duration of trips

where o1 represents the depot 1; c1/c2/c3/c4/c5/c6 represents the charging station at node 23/35/52/67/89/110; b1/b2/b3/b4/b5 represents the start point of route 1/2/3/4/5; e1/e2/e3/e4/e5 represents the end point of route 1/2/3/4/5.

Table 3: Transfer time and duration of each trip

ΔT	o1	c1	c2	c3	c4	c5	c6	b1	b2	b3	b4	b5	e1	e2	e3	e4	e5
o1	0	1	1	1	1	1	1	1	1	1	1	1	M	M	M	M	M
c1	1	0	1	2	1	2	1	2	1	2	1	2	M	M	M	M	M
c2	1	1	0	2	1	2	1	1	2	1	2	1	M	M	M	M	M
c3	1	2	2	0	1	1	1	2	1	2	1	2	M	M	M	M	M
c4	1	1	1	1	0	2	2	1	2	1	2	1	M	M	M	M	M
c5	1	2	2	1	2	0	1	2	1	2	1	2	M	M	M	M	M
c6	1	1	1	1	2	1	0	1	2	1	2	1	M	M	M	M	M
b1	M	M	M	M	M	M	M	0	M	M	M	M	6	M	M	M	M
b2	M	M	M	M	M	M	M	M	0	M	M	M	M	8	M	M	M
b3	M	M	M	M	M	M	M	M	M	0	M	M	M	M	10	M	M
b4	M	M	M	M	M	M	M	M	M	M	0	M	M	M	M	12	M
b5	M	M	M	M	M	M	M	M	M	M	M	0	M	M	M	M	10
e1	1	2	1	2	1	2	1	1	1	1	1	1	0	M	M	M	M
e2	1	1	2	1	2	1	2	1	1	1	1	1	M	0	M	M	M
e3	1	2	1	2	1	2	1	1	1	1	1	1	M	M	0	M	M
e4	1	1	2	1	2	1	2	1	1	1	1	1	M	M	M	0	M
e5	1	2	1	2	1	2	1	1	1	1	1	1	M	M	M	M	0

2.2. Parameters of the modified 123-node system

Case II in the paper is modified based on the standard IEEE 123-node system [R1]. Considering that we set up charging stations at different nodes, more loads are connected to the grid, which may lead serious voltage drops. we have reduced the distribution line impedance to one-tenth of the original without changing the base value.

2.3. Interruption cost of each load

The interruption cost of each node is listed in Table 3. The values are generated randomly in the range of [1,11].

Table 4: The interruption cost of each node

Node	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Value($/kWh)	3	4	9	9	2	6	10	1	11	8	11	4	3	2	11	11	10
Node	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34
Value($/kWh)	3	8	10	10	9	7	4	7	2	6	4	10	10	8	6	2	3
Node	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51
Value($/kWh)	2	2	7	8	3	4	5	6	9	6	3	9	11	9	4	10	5
Node	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68
Value($/kWh)	3	8	1	6	9	8	9	9	10	9	1	3	8	6	6	7	6
Node	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85
Value($/kWh)	7	5	4	1	8	3	7	8	6	9	5	7	8	4	2	9	1
Node	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100	101	102
Value($/kWh)	2	5	4	7	2	3	2	8	1	9	6	6	4	8	2	11	11
Node	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119
Value($/kWh)	3	4	8	6	2	3	3	8	9	10	6	6	2	8	6	7	7
Node	120	121	122	123													
Value($/kWh)	8	3	3	10													

2.3.1. Different groups of faults in Section VI-C

The groups of damaged lines used in Section VI-C in the manuscript is listed in Table 4:

Table 5: The interruption cost of each node

System	Number of damaged lines N_d	Set of damaged lines
33-node	9	1-2,6-7,6-23,9-10,9-15,12-13,19-20,23-24,29-30
123-node	8	1-7,13-118,12-18,18-115,60-119,101-120,72-76,117-122
	9	1-116,8-13,15-34,18-21,50-51,105-108,72-76,89-91,81-84
	10	1-3,7-8,23-25,44-45,53-54,60-62,67-68,76-86,106-107,112-113
	11	3-5,8-9,18-21,52-118,58-59,60-61,69-70,82-83,93-94,105-108,51-117
	12	3-4,18-19,26-27,23-24,76-86,95-96,97-120,57-58,44-47,95-96,105-108,110-111
	13	3-4,21-23,23-25,26-31,35-115,52-53,58-59,69-70,78-79,81-82,87-89,100-123, 113-114
	14	3-4,15-16,23-24,25-26,35-36,45-46,50-51,52-53,54-55,73-74,81-82,89-90, 106-107,109-110
	15	1-3,1-7,5-6,21-23,34-15,35-40,36-38,57-58,67-72,77-78,86-87,97-98,98-99, 106-107,119-67

According to the sequences listed in Table 4, the time interval for repairing two lines is calculated as:

$$\Delta T_R = ceil\left(\frac{33\Delta T}{N_d}\right) \tag{1}$$

where N_d is the number of damaged lines in each scenario.

Reference:

[R1] Kersting, W. H. (1991). Radial distribution test feeders. IEEE Transactions on Power Systems, 6(3), 975-985.